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ABSTRACT

This study describes the emerging themes and issues that impact on learning to teach science. The study examined whether the "language of schooling" that novices have been exposed to conflicts with the actual demands of practice, and how this conflict is resolved. Study participants were 14 Australian science graduates who had completed a Graduate Diploma in Education and taught for 2 years. Interview data are analyzed in terms of time involved in subject matter preparation, self-confidence, and collegial support. Results from the second year of the study suggest that the effects of university training are not "washed out" but are repressed as beginning teachers become immersed in the profession. Among the competing demands and complexities of teaching, teachers test the ideals they held in preservice training and come to accept what is possible. (Contains 16 references.) (JDD)

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ED 361 295

BRIDGING THE GAP.

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INTRODUCTION

In an attempt to better understand how science teachers learn how to teach, a study of one group of student-teachers embarking on their teaching career was initiated in 1991. As Sanford (1988) notes, the challenge faced by beginning science teachers due to the nature of the curriculum is complex. As opposed to many other curriculum areas, there is less consensus about what the curriculum should comprise or how it should be taught. Therefore, the beginning science teacher may find their role less well defined than might teachers of other subjects. In addition to this, the type of pre-service education program will also play a role in shaping the teacher's expectations of 'what it means to teach science'.

Eleven of the fourteen science teachers in this study completed their pre-service teacher training (Dip. Ed.) at Monash University. The course has developed and changed over a number of years as it has grappled with the issue of teacher education. The program integrates two types of development in the student-teacher. The first is largely cognitive (teaching content and context), the second comprises a significant affective component. A prime vehicle for the development of these two areas is focussed on the nature of student learning; Gunstone et al (1993) and Gunstone & Northfield (1992) describe the program and its development in detail.

Yinger (1987) asserts that "the language of schooling" novices have been exposed to may be in conflict with the actual demands of practice. If so, then how is this conflict resolved? The following analysis explores this question from a teacher's perspective as it attempts to unravel learning to teach science. This paper describes the emerging themes and issues that impact on learning to teach science for the fourteen participants in this study at the end of their second year of teaching.

METHOD

Eighteen science graduates, who had completed a Graduate Diploma in Education in 1990, were interviewed about their first year of teaching (1991). Of this group, fourteen remained in the profession and completed their second year of full time teaching in 1992. The initial size of this cohort was limited only by the number of students known to be in full-time employment (and able to be contacted) in Victoria in 1991.

Of the fourteen participants remaining in the project in its second year, ten were teaching in Melbourne metropolitan schools and four were teaching in Victorian country schools. All of the country placements were in Government schools while nine of the metropolitan placements were in Independent or Catholic schools.

Eleven participants had completed their Graduate Diploma in Education at Monash University. The other three were from different institutions but were teaching with Monash graduates and were keen to be involved in this study.

Teachers were interviewed at their schools (at a time which was convenient for them) late in the second semester of 1992. Participants were sent a copy of the research findings from 1991 (Loughran, 1992) and the interview protocol two weeks prior to being interviewed. This was designed to give them an opportunity to think about both the conclusions

drawn from the first year of the study, and the interview questions, so that their responses might be more considered.

Interviews were generally of one hour's duration. All interviews followed the same format. The paper outlining the first year's findings (Loughran, 1992) was discussed. The purpose of this was to ascertain the teachers' views on the conclusions drawn, and to gauge whether or not these findings *'rang true'* with the participants. Participants then focussed on the interview protocol and discussed their approach to science teaching. This included issues ranging from the influences on their approach to teaching, determinants of good (and not so good) lessons, student learning, the role of pre-service teacher training and teaching as a career.

The approach to these interviews was designed to explore the teachers' development as viewed by the teachers themselves. As there was a paper from the first year of the project, the first stage of the interview offered an opportunity to verify this analysis by the participants. This process also facilitated reflection by the individuals on their second year of science teaching and enhanced the recall of episodes (White, 1988) and experiences.

All interviews were audio-taped and transcribed and participants were given pseudonyms. Transcripts were coded and analysed using the computer software program NUDIST. NUDIST is a qualitative data analysis program which enables the user to sort and recall coded segments of data. Therefore, responses to particular issues or questions from different individuals may be more readily compared.

FINDINGS

As noted earlier, the interviews were designed to meet two aims. The first was to verify the analysis and conclusions drawn from the first year of the study, the second was to explore the teachers' development in their second year of science teaching. Examination of the first aim facilitates understanding of the research findings from the second.

Verifying the first year's analysis.

As outlined in the findings from the first year of this study (Loughran, 1992), attempting to categorise science teachers' approach to teaching did not seem appropriate (Table 1 below reviews the categories initially developed). This view was endorsed by the participants. All of the teachers in this sample rejected the notion of being a particular 'type of science teacher'. Although they recognised an approach which they preferred to use, or attempted to strive towards, they did not believe that any one approach was more apt as a descriptor for their teaching.

TABLE 1
FIRST YEAR TEACHERS' PREDOMINANT APPROACH TO TEACHING SCIENCE

APPROACH	TEACHERS (N)	TEACHERS (%)
1) Knowledge-based	2	11%
2) Skills-based	3	17%
3) Hands-on/Real world based	10	55%
4) Meta-cognitive based	3	17%

Source: Loughran 1992.

The following transcript illustrates a typical response to the use of categories.

> **Martha:** I guess one of the things where he [Loughran] was categorising people into these four approaches, I don't know if you can do that and he realised that you can't, he was trying to do it by generalising about people I guess...that's why I don't really agree with being able to categorise people because I think sometimes I'm in one category and sometimes I'm in another...just trying out different approaches to generate interest and stuff sometimes I'm in a lot of them [categories]...Yeah, I probably fit into 3 of them...you can't categorise people into one or another. I think it's just an attempt to tell others about the different approaches...like last year when I had Year 10 science I recognise now that I was more content based and knowledge based and stuff. Now I've only got the Year 7 Science and we're mainly concentrating more on skills and things rather than the content area. So yeah I feel a lot freer I guess. Concentrating more on skills rather than having to get through a set amount of stuff. Because I know I started off the year with my Year 7s thinking I've got to do this, get this, this, and this covered. Then just talking to some of the teachers and seeing that they're placing the emphasis more on skills and enjoying science, especially for these kids in their first year at high school, I'm finding that better now. Obviously some content comes into it, like in micro [micro-biology] I concentrated on using a microscope and making a wet mount and doing all those things rather than what the names of all the different parts of a cell are and all that; I'm not concentrating on that [content] as much at Year 7 level.

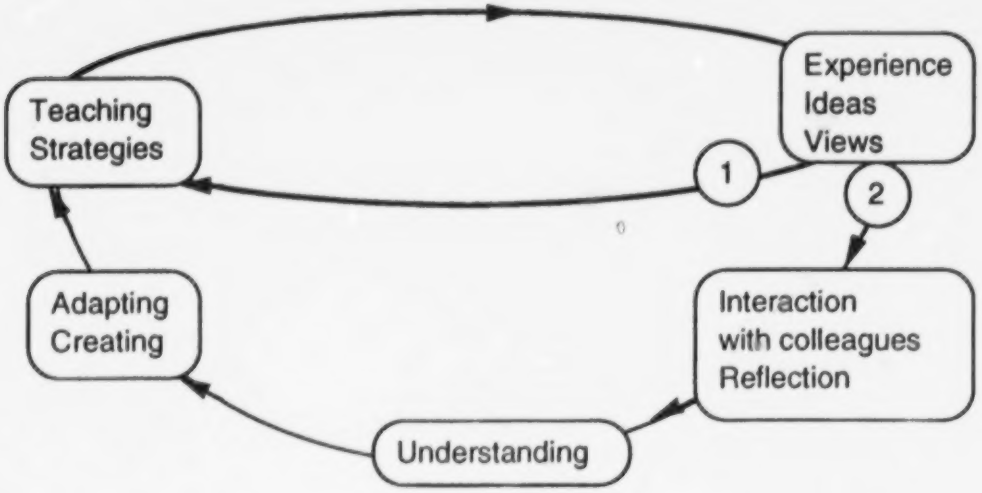
Noting the difficulty with categorisation supported the view reported in the first year's findings. Attempting to better understand how teachers' pedagogy developed led to the hypothesis that there was a cyclical process in operation; represented in figure 1.

In Figure 1, two approaches to the use of varying teaching strategies are illustrated. The first proposes that a combination of experiences, ideas and views combine to influence one's approach to teaching. An outcome of this approach might be the encouragement of greater participation and interest amongst students. The second is a path towards greater understanding of the teaching strategies. This involves interaction and discussion with colleagues about the approach, reflection on the experience in terms of what happened and why, and adapting and/or creating new teaching strategies as a result of an enhanced understanding.

Teachers on the first track are experimenting with teaching strategies to develop a diversity of approaches to teaching. However, these approaches might only be used in a given lesson or specific content area and simply be revisited when that unit is taught again.

Teachers on the second track are considering the purpose of the strategy and applying it to new and different situations as they develop ways of enhancing student learning.

Fig. 1: Two cycles in developing an understanding of teaching.



Source: Loughran 1992.

Participants had no difficulty identifying with this view (Fig. 1.) and could readily relate examples from their own science teaching to support their claims. The following extract illustrates how one teacher explained it from her perspective.

> **Interviewer:** On page 10 then, how does that diagram appear to you? Do you feel like there's something in that?
>
> **Liz:** Yeah. Well, yes I would say so. Yeah I get what you're saying. And yeah, I think there are times when you just use your ideas and then go onto the next thing and you've just used whatever good ideas you had. But then with others, when you reflect and try to work through them it's different.
>
> **Interviewer:** So I'm wondering what it is that makes the break that says this is what I'm spending more time trying to do in my teaching. Do you know?
>
> **Liz:** I don't know, I think some people don't care. So they just say, "Oh well I'll do this because I know it works." and it doesn't matter if kids have boring lessons. That's probably because you've just got to get through it [syllabus]. I would also say interaction with colleagues is very important, and if you've got colleagues that won't interact with you then that makes it really hard.

Most of the teachers spoke in a similar manner to this. However, what was interesting was that although they could all identify with the view outlined in Figure 1, most did not claim to be operating in the second (outer) circuit. The first year's research had led to the hypothesis that those who were operating in the second circuit were more concerned with student learning. Therefore, their approach to better align teaching strategies with student learning rather than with the transmission of content knowledge alone. Therefore, exploring where teachers placed themselves and why (in figure 1) was of interest. This resulted in the elaboration of

some unusual difficulties faced by beginning teachers. The next section examines some of the issues associated with 'Bridging the gap'.

Analysing the second year's data.

As none of these teachers were experiencing difficulties in terms of classroom management, their ability to discuss their own teaching often demonstrated considerable insight, maturity and honesty. The major issues that they recognised as affecting the development of their pedagogy were time, self-confidence and collegial support. Many of these teachers find themselves in a position where they are struggling to 'bridge the gap'. This struggle is centred on that which they think they should be doing in terms of student learning, and what they can do in the real world of school. Bridging the gap may be made difficult when their expectations from pre-service training are confronted by the realities of day to day teaching.

The following issues influence how these teachers view their attempts at bridging the gap.

Time

As Feiman-Nemser & Parker (1990) noted, subject matter concerns permeate the tasks of teaching. For these science teachers, being able to deal with subject matter concerns was influenced by the availability of time. The issue of time was in two dimensions. The first was the difficulty of finding time to think about how to teach a topic. The second hinges on the time necessary for the teacher to be a learner so that a greater understanding of the topic might be gained. Both impact on pedagogy and student learning outcomes.

A typical explanation of the first dimension of this was given by Joshua.

> ...well there's no way I can prepare all my lessons, I don't have time. So a minimal preparation, I'll teach the lesson and then tap dance on top of that. Which is OK well start of...I might go OK you guys separate into 2 groups, now ah, OK you guys number off, right we're having a quiz, right off you go. And you teach them the concepts. OK then you think, they've got that, most of them, how can I deal with this now, the exercise in the book I want you to do questions 1 - 12. That will get most of them sorted out and I can talk to these 2 kids who are having trouble with it. And so on and so forth, actually once you, what I mean is you know what you're going to teach but the actual teaching techniques you're going to use haven't been sorted out yet.

In this quote, Joshua encapsulates the view of so many of the participants in this study. He describes how a lack of time to prepare his classes impacts on the way he teaches. This lack of time to think about how to teach particular concepts or content inhibits the development of what Shulman (1987) describes as pedagogical content knowledge. Therefore, instead of thinking about ways of teaching to enhance student learning, a situation arises whereby teaching may occur more in an off-the-cuff manner. This is in stark contrast to the often planned and reasoned approach of their Dip. Ed teaching experiences. This seems counter productive but is a situation not uncommon to many teachers. This is exacerbated for some of

those employed in Private schools. The difficulty being that for these schools, the measure of their success (being a 'good' school) is often determined by the proportion of their students who gain University entrance. Therefore, the measure of a good teacher can hinge on students' final year grades. So time for preparation is given to the senior classes in preference to the junior classes

> **Mitchell:** ...in a school like this there's such an emphasis on getting Year 12 to pass, and not only to pass but to get really good results, because it's the bread and butter. So with that emphasis I tend to take time from Year 9 and put it into my Year 12's.
>
> **Interviewer:** And you'll pay them back when they're in Year 12?
>
> **Mitchell:** Yeah, and that's how it works at the moment.
>
> **Interviewer:** Might be a big debt.
>
> **Mitchell:** Yes, I think that is actually happening now. I think it's a debt that is noticeable now, as I know teaching my Year 12's, a lot of them don't know the basic principles.

Instead of enhancing one's own teaching skills, an emphasis on training for assessment becomes the over-riding principle. Rather than a teacher being encouraged to develop specialist teaching strategies for particular content or concepts, there is a competing demand to develop strategies for students to perform better at assessment tasks.

A lack of time in this instance helps to perpetuate the cycle which rewards learning for assessment rather than learning for understanding. Although teachers may very well recognise this, they still face the dilemma of dealing with these competing demands.

The second aspect of the lack of time relates to how the teacher learns. In order to develop lessons that enhance student understanding, the teacher needs to be 'at ease' with the content. In order for this to happen, the teacher needs time to learn the content and to think about how that learning occurs.

> **Liz:** I can't think through many ideas and that because I'm still getting used to the material myself. So probably when I've taught it a couple of times, you know if I've taught it once, then I'm used to the content, so I can start looking for better ideas.
>
> **Interviewer:** So what are you saying, because you're a chemistry specialist the call on other content knowledge in junior science is too demanding?
>
> **Liz:** I think it takes more time, yeah. I wouldn't say it's too demanding because I think I find it very interesting and I know last year I found it really interesting. But it just took more time to, because I had to make sure I understood it, well I have to do that anyway, but it takes more time to make sure I understand it before I can go on trying to think of innovative ways to do it. Because I'm not so familiar with all these other

whizz bang pracs and ideas. If I'm teaching science I probably try to do introductory pracs and things like that. Like if there's concepts to learn, if it's something like the body where it's just a lot of information then I tend to give them a bit of information and then, you know, just do pracs.

Interviewer: So is it fair to say, and tell me the opposite if it is, is it fair to say that the better you understand the content, maybe the more directed you are to knowing what to help the kids to discover....

Liz: Yes.

Interviewer: in the concepts because maybe you remember discovering them yourself?

Liz: Yes. Or I can think of new ways to help them discover it because I know different ways to approach it. I really think that is what it is.

Liz summarises this point well. In learning (or in some cases re-learning) the content, important links are made in the teacher's mind which influence the pedagogy developed or implemented in the classroom. This aspect of learning to teach science may well be overlooked when time is of the essence and just trying to keep up with the demands of the syllabus are paramount.

Better aligning teaching with learning is the crux of recognising and developing pedagogical content knowledge. Teaching in specialist content areas may inhibit this in some science teachers. Through linking learning and teaching, it may be that involvement in teaching general science in content outside one's field of expertise is as important in learning to teach science as teaching in one's area of speciality. For the beginning science teacher the ability to do this, or to want to do this, may be affected by their confidence with content outside their specialty field.

Confidence

Confidence in one's own ability may be reflected in a number of ways. All of the teachers in this study spoke about their confidence in terms of being more relaxed in the classroom, being able to try out new/different things in their teaching, or being more at ease with their role generally.

Mary: I feel a lot more comfortable this year than I did last year. Also being at a new school the girls, I've found that the girls last year, whether it was in my mind or that it was real, gave me more of a hard time...that was probably because of my approach. This year I am able to be myself but still have their respect. I'm much more confident.

Interviewer: You're more relaxed.

Mary: Yeah, and I guess I'm developing what I like and what I don't like to use. And what works for one class doesn't always work with another...there's a good atmosphere between myself and the students in the sense that there's not me and them, there's a we, so we work together. That causes

me to relax...this year I was very lucky, if one could say that, because I developed that relationship with all my classes.

Having experienced the complexities of teaching throughout their first year, the value gained from the confidence that results from 'surviving' is important in the individual's development. Many of the approaches to teaching that may have been considered but rejected as 'risky' may now be taken on board as a result of this increased confidence.

The importance of this confidence is demonstrated by Mary.

> I guess there's probably two things. For starters it's the girls' enthusiasm. If I see that they can work when I try maybe threatening activities to myself because I haven't tried them before, or I don't know how it's going to work out, and they really work at the activity and are really good, I don't mind trying new things, new activities.

Through the development of this confidence there is a shift in the approach to teaching. This shift is noticeable in the amount of involvement students begin to have in the lessons. They are given an opportunity to contribute, to voice their opinion and to test their ideas and understanding of the concepts being considered.

Although there is a recognition that conducting teacher centred lessons is not always the best way to enhance student learning, a lack of confidence inhibits the teacher's ability to hand over some of the responsibility for learning to the students.

The pedagogical freedom created through increased confidence helps this handing over to occur. The teacher has less of a need to feel as though they are the sole source of knowledge. There is a realisation that students themselves have important ideas and information to contribute. Loading the students with information before they see the relevance or purpose of it may be counter-productive to meaningful learning.

> **Gary:** I've looked at that and thought notes are good and you do learn through them, and we did lots of pracs as well, but there wasn't much discussion or interaction like that. Second semester I've got a physics unit called floating and flying and it's physics based and we've had a lot more discussions in that, talking about different issues, not issues sorry different concepts to do with it. So even in that time I've got more, I suppose it's got a bit to do with the topic as well, but I've become more interaction based, rather than teacher based going this is the teaching, here it is...people see things float, people know that if you get in a pool you only float up to here [pointing to the eyes]. We haven't started flying yet, but people have ideas in their head, why does a paper plane go, and you can talk about that because they've seen it happen...there was a discussion I had with one of the kids. He asked, "Why don't we sink, or why do we float up to here?" he [student] initiated that discussion. But that's an example of the interaction that I've talked about before, where I've been a lot freer to do that this year. I haven't felt like it's wrong, or not that it's wrong but I've felt that I've got time enough and I'm relaxed enough to do that.

Interviewer: Can you think of why you think you've got more time in class?

Gary: Perhaps I'm more willing to do things that aren't teacher centred. Like classes that aren't just teacher directed classes where you need to be directing, need to be talking to people all the time, need to be pushing. I'm more able to have lessons where the students are free to go off and do their own stuff. Where you don't need to be pushing them all the time.

Many of the teachers spoke about their teaching from this perspective of increased confidence. A confidence that allowed them to be more flexible with what they were doing in their classes. Flexibility derived from thinking more about what they were doing and why on a more regular basis.

Carol: My questioning is more directed towards an end point now because number 1, having done it before I know what my end point is, and number 2, I'm more confident in getting them to that point...I would rather question and get the discussion going first to have them think about it and what they know about it so that I know what I'm starting with, rather than just saying we're going to take notes on energy and where they've got no concept of energy. Why waste time writing down something when they haven't discussed it.

It is fortunate that for many of these teachers the difficulty of finding time to improve their teaching is counter-balanced by their increased confidence in their own ability. Although there is some frustration at being able to balance all of the demands of teaching, coping with these demands is possible through increased self confidence.

Support

The value of working in a supportive environment was continually noted by these science teachers. The benefits of this support often being reflected in their descriptions of their pedagogy. However, support in this case is in two distinct forms. Collegial support through sharing ideas and approaches to teaching content, and student support for encouraging (or discouraging) continued efforts to help students learn in appropriate and relevant ways.

Collegial support varied from informal discussions over a cup of coffee, to more formal and structured in-services and faculty meetings. Generally, this form of support was similar to that found in science departments throughout Australian schools (Loughran & Ingvarson, 1991a & b) and is important in encouraging teachers to learn from, and with, one another. The benefits for their pedagogy often being immediately noticeable to them.

Dianne: Well, I always believe in interaction.

Interviewer: Yes, and you have the opportunity of that here?

Dianne: Yes, the Chemistry teachers meet every 2 maybe 3 weeks. We swap ideas, swap notes and can go away and reflect on how you want to do things...my last science coordinator was

constantly handing me ideas and constantly looking over my shoulder and saying, "I had the chance of doing that exact class and I found this really interesting to do." and stuff like that. So I'd say interaction with colleagues I think is great, you can pick up a lot of experienced teachers' ideas. I'm open to that every time, especially when it's a new subject.

In many ways this form of support can be viewed as a way of maintaining the desire to teach in ways that are appropriate for encouraging student learning. As Lortie (1975) noted, teachers have to learn to live with few indicators of success. Sharing ideas about approaches to teaching, then carrying these out in the classroom, may be one of the few tangible measures of success for a teacher. Therefore, the presence of collegial support is important.

For those with good support mechanisms, this point was particularly valid. They were able to immediately note how they were buoyed by the support and encouragement of a close colleague. This type of support is important as it encourages reflection on practice.

Stuart: Having another person there is really terrific because you say, "I'm going to do this." and he says, "Why?" and we talk about why to do things, it's the biggest influence that I've got. I think that's really good, without it I think I really would have been tempted to be expedient and just see myself going in that direction..I think if he wasn't there I would slip into the way of the world to a degree. I think it's really useful having him there.

Collegial support is one mechanism for beginning science teachers to learn more about teaching, but student support is equally important. When a teacher has put a lot of time, effort and planning into the preparation of a lesson or unit of work, the desire to continue to explore new and valuable ways of teaching can be dashed if students do not support these efforts.

When students respond well to a teacher's efforts, there is a sense of achievement and purpose that is a reward for making the effort. It supports the view that making the effort is worthwhile. Although much of this support appears to be tacit. If students enjoy their work, or they approach a task with vigour, or the teacher is encouraged by students' questions, then this supports the teacher's efforts and increases the likelihood that this type of approach might continue.

Anthony: Well enthusiasm in the class, if the kids are enjoying it, it's got be interesting for them...also I've found especially - I take a little bit of physics and a little bit of electricity - and I've found that in some lessons that the kids just didn't want to go. They'd want to ask questions.

Interviewer: Didn't want to go, what do you mean?

Anthony: Didn't want to go to the next class. When the bell had gone and it was time for them to move on, they would remain and ask questions about electricity.

Unfortunately, the converse is equally true, and in many cases much more apparent. When teachers are not encouraged by their students' responses or attitude, the need to make an effort, to push one's own pedagogical reasoning may well be lost.

> **Simon:** And it's also what the kids think learning is. That is one of the biggest hurdles. I can do these really good things and they say, "What are we doing this for?" and you say, "Well don't get so hung up about it, just enjoy what you're doing and contribute."
>
> **Interviewer:** Learn from it?
>
> **Simon:** Yeah or get what you can out of it. And they go, "Oh no." and you structure some really good activities and think, "These are going to be great, they're going to love them." and they hate them...You can spend all your time planning to come off this cycle that you're talking about [figure 1], but unless you get that feed back from it and you feel like the kids are enjoying it and they're getting something out of it, sometimes you just revert back to doing things the old way.

Much of this type of support is linked to the individual's view of learning. As teachers consider how to better align their teaching with their view of learning, their students' responses have a big impact on their thinking and actions. They are discouraged when students' views of learning inhibit their approach to different activities and learning experiences. When the effort is made to better relate teaching to learning, student support is crucial. Without it, the impetus for reflection on practice is easily lost.

The issues in context

These three issues combine in an interesting way for the science teachers in this study. The theme adopted to describe the context of these issues is 'bridging the gap'. The gap refers to the difference between their expectations from their pre-service teacher training and that of the real world of schools. For many there is a struggle - played out through the issues raised in this paper - to come to grips with the difference between what they think they should be doing, and what they can do for their students.

This struggle challenges them to think about what is possible and what is realistic as a beginning science teacher. During the interviews all were asked about what they saw as influencing their pedagogy. Eleven spoke about their Dip. Ed. year and were able to describe how this had been important in their development. Their Dip. Ed. experiences have contributed to the dilemma they now face.

The time, confidence and collegial support found in their Dip. Ed. encouraged them to risk exploring teaching and learning in different ways. The memory of the course lingers in a way that may be more romantic with time, but lingers nonetheless.

> **Irene:** I loved it and I found the most useful thing, Teaching and Learning, that section of Dip.Ed. with the journals, cause as I said I'm pretty reflective. I enjoyed that, I got so much out of that and I think in some ways I really miss that. And people said well you should continue, but I'm just so exhausted.

Anne: I think the Dip.Ed. course has had a great impact, just the outgoing, giving you the outgoing nature and the will to try and to do the best you can. Just to get out there and give it what you have and to try different techniques, just to never stop trying to get the students to learn. It's hard to explain but the Dip.Ed. course gave me that confidence to go out there and give it a try and never to feel wrong but to know that I can improve. I've never really felt wrong in the way I've taught something. I've just come to decide that maybe that's not the way to do it next year. I don't look at it as wrong, I just look at it as being a learning episode for me and I can change things from there.

As the memory lingers, so the expectations developed during that time surface. Reflecting on the Dip. Ed. experience and comparing those memories to current practice raises interesting responses. For some it was an experience to return to for rejuvenation, for others it was an experience that is difficult to revive in their own classes.

Anthony: I have obviously carried on ideas that I picked up in Dip.Ed. and there are a lot of ideas that I've probably forgotten. Through Dip.Ed. I sort of hoarded stuff, I liked to keep everything that I did at Uni...So when I get bored with teaching what I'm teaching, I go back and just pick up a new method...I'll look for alternative methods, I'll go back, have a look, see a different way to approach it.

Interviewer: Can you give me some examples of that?

Anthony: Probably in chemistry. Talking about atoms and elements and those sort of things. I found that it's very descriptive and it's very hard for students to grasp. I couldn't think of a way to get it across to them and I remembered that somewhere in chemistry back in Dip.Ed. we did, I think it was called Atoms party. It was one particular way, it was like writing a party about atoms, like...Instead of keeping a formal structured text where you read and then copy the answer, it was a creative piece where they use the atoms or their element names and they come to a party. And hydrogen met up with chlorine and formed hydrochloric acid so something like that...they were learning from it. Because they'd asked, well can hydrogen go will chlorine, can hydrogen go with oxygen, and what ratios are they allowed to go in. They learnt a fair bit.

Ron: Well I found everything with Stream 3 [Dip Ed. for science graduates], the science component of it, that all the teaching techniques were sort of demonstrated in the way that the lecturers were actually trying to teach us and give us a broader background knowledge of our subject areas. You've always got that in the back of the mind whenever you're doing something and it's sort of an ideal to try and go for. I think that the way that they were doing it was one of the ways of teaching, but also I realise that there's a lot of work involved in teaching in that way.

Irene: I think in some ways I was a better teacher when I was in my Dip.Ed. than I am now. That sounds really stupid. Because we had much more time in teaching rounds to prepare, I know that sounded negative, I know. But I mean it. I felt that we had so much more time to reflect on what we did, we had so much time to think about what we would do, we had so much time, I mean together.

Bridging the gap from the ideals of Dip. Ed. to the real world of school is bound up in a context in which expectations are pitted against the practicalities of 'doing the job'. Doing the job does not always include teaching for enhanced student learning. This is the dilemma these teachers presently face.

Mitchell: ....most things I learnt in Dip.Ed. are totally contradictory to what I'm doing now. But in the future...In actual fact when I was reading that article I was sitting there thinking about it...I read a couple of the things that other teachers had used in these excerpts that I had just totally forgotten about, at the moment that sort of teaching had just totally gone out the window.

Stuart: I'd love to have lessons that excited the kids, but it seems to get put on the shelf because of the fact that I've got a certain amount of lessons that have to be done by tomorrow...that's the biggest problem I find personally.

Interviewer: So you spoke of this rut ahead of you

Stuart: Yeah, I can see that, I've thought about it myself this year about when I came out of the Dip. Ed. and also out of teaching last year, I could see, you know, my lessons aren't as creative as I'd like them to be. I've found that because of expediency I find myself teaching lessons that when I was in Dip. Ed., I would've scoffed at and pointed out the faults and now I find myself doing it...I don't think it motivates the kids, I don't think it enables them to learn effectively...I didn't want to be teaching like that as much I find myself doing.

CONCLUSION

This research project is a longitudinal study of science teachers' development. The impetus for this study was to better understand the development of science teachers' careers and to explore some of the factors which influenced and shaped their pedagogy. Zeichner & Tabachnick (1981) described the attitude shift that student teachers made when they moved from University course work to school teaching. They highlighted the regression in student attitudes toward more traditional viewpoints as they became immersed in the profession. The findings from the second year of this study suggest that the the effects of University training are not so much 'washed out' as repressed. Amongst the competing demands and complexities of teaching, the ideals once held in pre-service training are tested in the real world of school. There is not so much an attitude shift, as they still adhere to the notions of learning encountered in their Dip. Ed., more so an acceptance of what is possible at this stage in their development.

Attempting to come to grips with how to teach science in ways that are congruent with their views on learning, being able to do this within the constraints of time, and gaining appropriate support will all continue to impact on their confidence in their pedagogy.

Bolin (1988) described the philosophy of her pre-service program as holding that there are many divergent approaches to teaching that are of merit. The purpose of the program was to enable students to be more thoughtful about their perspective on these. In a sense, this is also one of the aims of the Dip. Ed. that these teachers completed. The quotations in this paper demonstrate a thoughtfulness by the teachers, but this is strained by the reality of the context of schooling.

Although these teachers would be able to demonstrate that they had what it takes to be a competent beginning teacher (Reynolds, 1992), there is more than this influencing their development.

It will be interesting to see how these issues impact in their third year of teaching. Will their pedagogical knowledge develop sufficiently to give them the confidence to take the time to review what is possible in science teaching and learning? Are these teachers likely to start teaching 'against the grain' as Cochran-Smith (1991) describes it? Does the profession give sufficient support to the individual to embark on this path? These are some of the questions that will guide this research project into its third year.

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REFERENCES

Bolin, F. (1988). Helping student teachers think about teaching. Journal of Teacher Education, 39 (2), 48 - 54.

Cochran-Smith, M. (1991). Learning to Teach against the Grain. Harvard Educational Review, 61 (3), 279 - 310.

Feiman-Nemser, S., & Parker, M.B. (1990). Making subject matter part of the conversation in learning to teach. Journal of Teacher Education, 41 (3), 32 - 43.

Gunstone, R.F., & Northfield, J.R. (1992). Conceptual change in teacher education: The centrality of metacognition. A paper presented at the annual meeting of the American Educational Research Association, San Francisco, April 1992.

Gunstone, R.F., Slattery, M., Baird, J.R. & Northfield, J.R. (1993). A case study exploration of development in preservice science teachers. Science Education, 77 (1), 47 - 73.

Lortie, D.C. (1975) Schoolteacher, A Sociological Study. Chicago: The University of Chicago Press.

Loughran, J.J. & Ingvarson, L.C. (1991). Keeping Up: A dilemma for science teachers. Research in Science Education, 21, 234 - 243. (a)

Loughran, J.J. & Ingvarson, L.C. (1991). Loose connections: Science teachers' views on status, careers, evaluation and professional development. A paper presented at the Australasian Science Education Research Association Annual Conference, Gold Coast, Queensland, July 1991. (b)

Loughran, J.J. (1992). Becoming a Science Teacher: First year teachers' approaches to learning about teaching. Research in Science Education, 22, 273 - 282.

Reynolds, A. (1992). What is competent beginning teaching? A review of the literature. Review of Educational Research, 62 (1), 1 - 35.

Sanford, J.P. (1988). Learning on the job: conditions for professional development of beginning science teachers. Science Education, 72 (5), 615 - 624.

Shulman, L.S. (1987). Knowledge and Teaching: Foundations of the New Reform. Harvard Educational Review, 57 (1), 1 - 22.

White, J. (1989). Student teaching as rite of passage. Anthropology and Education Quarterly, 20, 177 - 195.

White, R.T. (1988). Learning Science. Oxford: Blackwell.

Yinger, R.J. (1987). Learning the language of practice. Curriculum Inquiry, 17 (3), 293 - 318.

Zeichner, K.M. & Tabachnick, B.R. (1981). Are the Effects of University Teacher Education 'Washed Out' by School Experience? Journal of Teacher Education, 22 (3) 7 - 11.